THE TWIN-DEFICITS HYPOTHESIS: A CGE INTERPRETATION FOR THE U.S. ECONOMY 1982-1986

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February 1992

ABSTRACT

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The plausibility and implications for U.S. agriculture of the absence of a relationship between the budget deficit and real interest rate is investigated using a CGE model of the U.S. Results imply that the budget deficit must have caused the dollar to appreciate by raising the real interest.

I) Introduction

The policies of the Reagan era greatly disturbed the major macroeconomic balances of the U.S. economy. The government deficit and by high levels of foreign borrowing increased sharply. Along with the rapidly rising current account deficit, the 1980s became a decade of internal and external imbalances. The effects of high interest rates and dollar appreciation were felt more by agriculture than by many other sectors during this era.[1]

The attempts at explaining the simultaneous occurrence of rising budget and current account deficits in the 1980s started a search for a systematic relationship between these two deficits. With the revival of Mundell-Fleming model as the theoretical support for a proposed causality relationship between the budget and the current account deficits,[2] the search led to a lack of consensus in macroeconomics which soon spread to agricultural economics. At issue in the broader sense is the existence (or lack) of a causal relationship between the budget deficit and current account deficit (Tallman and Rosensweig). On a more specific level, the question is the existence of the budget deficit real interest rate linkage (e.g., Belongia and Stone; Barclay and Tweeten).

Whereas some researchers were conducting various statistical causality twin deficits relationship (e.g., Darrat; Abell) others began testing for an altogether

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[1] Typically high capital-labor ratios in U.S. farming along with the net debtor position of the sector made the effects of rising interest rates more pronounced. Also, due to the relatively heavier dependence of agricultural sector on exports, the appreciation of U.S. dollar led to a deterioration of the sector's international competitive position more severely than many other export sectors With the dollar's higher purchasing power, imports boomed benefiting sectors with higher imported input use. Consumers and service industries also enjoyed the results of the policy mix of the Reagan administration (Tweeten). In general, changes in the relative price structure induced by the macro swings shifted resources away from sectors producing tradables toward non-tradables (Adelman and Robinson).

[2] By this approach, often referred to as *Twin Deficits Hypothesis* (TDH), as the budget deficit increases, the real (inflation-adjusted) interest rate tends to increase. This in turn, attracts foreign capital into the country as foreign investors buy U.S. assets, and increases the demand for dollars thereby causing the dollar to appreciate in real terms. Since a higher valued dollar tends to decrease exports and increase imports, the (merchandise) trade imbalance worsens, negatively affecting the current account balance.

different hypothesis (proposed by Barro) that became known as the *Ricardian Equivalence Hypothesis* (REH) (e.g., Evans; Enders and Lee). Put simply, the debate between the TDH and REH advocates is over which of the private savings, S, and the foreign savings, (X-M), terms of the savings-investment balance

$$I = S + (X-M) + (T-G)$$

should *necessarily* adjust in response to a change in the net government savings term, (T-G). (T-G)<0 implies a budget deficit. Similarly, (X-M)<0 implies a deficit in balance of trade on goods and services.[3]

Because the first linkage in the causality chain suggested by the TDH is the real interest rate, failure to find evidence for a positive relationship between the budget deficit and the real interest rate is taken as the reason to reject the TDH. Using different theoretical/empirical frameworks, a number of researchers report lack of evidence for a positive relationship between the U.S. budget deficits and interest rates (e.g., Plosser; Belongia and Stone; Evans 1987). Results found by others (e.g., Barclay and Tweeten; Abell) to the contrary aside, such a lack of evidence implies that even if the budget deficit grows, the real interest rate would not rise and hence foreign capital inflow would not be affected.

This paper investigates the plausibility and implications for U.S. agriculture of the absence of a positive relationship between the budget deficit and the real interest rate using a CGE model of the U.S. economy. Assuming that there really is no causal linkage between the U.S. budget deficit and the real interest rate

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[3] By the conventions involved in reporting the U.S. National Income and Product Accounts (NIPAs) data and by the Balance of Payments Accounting (BPA) conventions, (X-M) term in the GNP identity and the current account in BPAs are not equal to each other. The conversion of one to the other is explained in *Survey of Current Business* (June 1987). To avoid confusion in the following discussion, superscript "NIPA" is used to refer to the (X-M) term in the GNP identity and superscript BPA is used to refer to the current account position in the BPAs. What is referred to as "foreign capital inflow" in this paper is the long-term capital item in the capital account statistics of the BPAs. Therefore, the following holds:

$$(X-M)^{NIPA} = (X-M)^{BPA} \pm C \equiv \text{"Foreign Capital Inflow"} \pm C$$

where C is a term taken as a constant in the model.

(and hence the foreign capital inflow), two counterfactual comparative-statics experiments are designed. The first experiment simulates the position of studies that have found no evidence for the budget deficit-real interest rate relationship using non-Ricardian Equivalence frameworks. In the second experiment, the nominal investment is fixed at its base value and the household savings rate is allowed to adjust to rule out crowding out of investment by the increasing budget deficit. This experiment therefore is consistent with the REH. The counterfactual simulation exercises here are intended to show, in a neo-classical CGE context, what would have happened to some key real variables and macro aggregates if the budget deficit had indeed no effect on the real interest rate and foreign capital inflow.

The organization of the paper is as follows: The next section briefly describes the model and the nature of simulation experiments. Some results from another CGE study (Adelman and Robinson) are presented and its differences from the present study are indicated. In section III, the results from this study are reported. Finally, Section IV includes concluding remarks.

II) A Brief Description of the CGE Model and Experiments

An 18-sector CGE model is constructed to observe the comparative-statics effects on U.S. agriculture of simulated changes using 1986 as the base year. With a few exceptions the model structure is quite similar to that of the 10-sector USDA/ERS CGE model by Robinson, Kilkenny and Hanson (RKH). Although the sectoral classification is different due to aggregation into 18 sectors, it shares a common data base with a 30-sector version of the RKH, and it can be found in

Kilkenny.[4] The solution for the model can be obtained by using any of the PC versions of GAMS.

The model has eight agricultural sectors: Dairy, Livestock, Food Grains, Feed Crops, Oil Crops, Cotton, Sugar and Other Crops. Eight sectors in the original 30-sector data base, processing inputs from the eight agricultural sectors, are aggregated into a single sector under "Food Processing."

The U.S. CGE model requires simultaneous clearance of all goods/services and factor markets. It is a Walrasian model with relative price adjustment bringing about the equilibrium in these markets. Relative prices (including those for factors) are determined through marginality conditions of the neo-classical theory. On the macro side, the model includes the investment-savings balance and balance of payments equilibrium condition but does not have any asset or money markets. Therefore, the items financing $(X-M)^{NIPA}$ including the foreign capital inflow is exogenous to the model which determines an equilibrium relationship between the exchange rates and $(X-M)^{NIPA}$. For convenience, all prices for 1982 are set equal to 1 so that quantity variables are measured in terms of 1982 prices. Nominal flows are measured in current base year (1986) prices. Since the model satisfies Walras' Law and homogeneous of degree 0 in all prices, a numeraire is needed. Consistent with the convention employed for measuring real (quantity) and nominal flows the GDP deflator (defined as the ratio of the nominal GDP in 1986 to the nominal GDP in 1982) is chosen as numeraire.

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[4] RKH presents a detailed description of the original USDA/ERS model. Except for the differences indicated below, model detail will not be given here. However, full documentation is available upon request from the authors.

For private final consumption demand, a single representative household that allocates its income among goods and services subject to an LES utility function is assumed (instead of three household categories in RKH). Final consumption demand by the government is exogenous in real terms for each sector but, differently from RKH, *not* given as a predetermined fraction of real aggregate government expenditure. Finally, sectoral inventory demands are functionally related to composite commodities by sector instead of domestic output only.

Using an earlier version of RKH, Adelman and Robinson measure the effects of the macroeconomic policy mix of the Reagan era on U.S. agriculture under three counterfactual scenarios. One of the questions is: "Ceteris paribus, had we achieved the same balance of trade surplus [$(X-M)^{NIPA}$] as in 1980 (the last Carter year), what would the effects have been?" Two of the major findings are a 15 percent depreciation of the dollar and an 18 percent increase in the return to land (the rent) (p. 146):

> "[...] the 15 percent revaluation in exchange rate relative to 1982 which occurred in 1986 would not have taken place had we not borrowed from abroad. Exporters would not have suffered a loss in competitiveness and imports would have been $83 billion less than they were in 1986."
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> "[...] assuming full capitalization, the price of land would have been some 18 percent higher in 1986 if foreign capital inflows had been at their 1980 level. This computation assumes no change in the real interest rate. In fact, the real interest rate rose dramatically during this period, a rise that was required to attract the foreign savings."[5]

The study by Adelman and Robinson sheds some light on the effects of the macroeconomic policies on U.S. agriculture. It is not concerned about the TDH controversy but rather is an effort to measure the effects of the "macro swings" of the period under the Reagan Administration. In the counterfactual experiments here, rather than the $(X-M)^{NIPA}$ term, only the foreign capital inflow is returned to a pre-base year value. That is, a hypothetical case is simulated where the increase in the U.S. budget deficit did not affect the U.S. real interest rate.[6]

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[5] Adelman and Robinson point out that the real interest rate in 1986 was about 6.4 percent -- about three times as high as the 'normal' long-term real rate. At any degree of capitalization, they argue, the rise in real interest rate inflicted much bigger declines in land values than occurred through the land rental rates. The two effects working together in the same direction lowered the land prices dramatically, causing, in turn, financial problems for farmers who had borrowed against land (for the same points, also see Tweeten).

[6] The real interest rate is kept constant by model formulation. The term does not appear explicitly in any model equation. The ratio of foreign capital inflow to GDP is used to eliminate the effects of inflation between 1982 and 1986.

Consequently the foreign capital inflow does not increase -- a consequence consistent with the lack of empirical support for the budget deficit interest rate relationship.[7] Also differently from Adelman and Robinson, the 1982 (rather than 1980) level of foreign capital inflow is chosen to be fixed here.[8]

In the first experiment, the model briefly described is used without any changes in its mathematical structure. So, by fixing the 1982 ratio of foreign capital inflow to GDP without changing the base year (1986) value of budget deficit, the experiment simulates that the budget deficit is not related to the current account deficit (the general anti-TDH position which is not necessarily pro-REH). In the second experiment, household savings expand to finance the budget deficit so that investment is not crowded out.[9] This experiment therefore is consistent with the REH position. For the base year, the two versions must give exactly the same solution. When subjected to exogenous shocks, they produce different values regarding the nominal and real domestic absorption (Tables 1 and 2).

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[7] The budget deficit measure is the sum of the federal and state/local budget balances as reported in SCB (Account 3 in Summary NIPAs). This is the relevant budget deficit measure since it is the one included in the savings-investment identity for the U.S. (Account 5 in SCB Summary NIPAs). Compared to the federal deficit alone, this is a more modest measure of the "budget deficit" since state and local budgets have consistently been in surplus during the entire period under examination (1980-1986) -- see SCB, July 1983 and July 1988 issues.

[8] The reason is that the U.S. budget deficit in 1980 was only 21.3 percent of that in 1986 (30.7 billion and 144.4 billion in nominal dollars, respectively). Even after adjustment for inflation, the 1980 deficit is too small in comparison to the 1986 deficit. It is possible to argue that a large enough (and unexpected) jump in the budget deficit may cause an adjustment in the current account --the REH hypothesis admits this possibility. After adjustment for inflation between 1982 and 1986, the growth in budget deficit is found to be about 8 percent. Therefore, the following results assume that an 8 percent (real) growth in the budget deficit. Presumably, the real increase in the budget deficit is small enough to be consistent with the findings that are simulated.

[9] Without the household savings adjusting, a reduced foreign capital inflow would lead to budget deficit directly crowding out nominal investment. That is, with both BOP capital account and household savings adjustment possibilities limited, the budget deficit must lead to a reduced investment. However, since the nominal investment is fixed for experimental purposes, household savings must adjust to prevent this effect of the budget deficit.

III) RESULTS

The results from both experiments are similar to those in Adelman and Robinson. In particular, U.S. dollar depreciates 9.8 and 10.3 percent under experiments 1 and 2, respectively. The conclusion common to both exercises is that if the budget deficit did not have an effect on the foreign capital inflow through the real interest linkage, U.S. dollar would not have appreciated as much as it actually did between 1982 and 1986. Had this been the case, higher exports, lower imports and a lower current account deficit than the actual values observed in 1986 would have been the result (Table 1). Another important point to observe from Table 1 is that the investment demand would have been about 19 % less than it actually was in 1986 (in both real and nominal terms) had the budget deficit increased without foreign savings being able to adjust (Exp.1). This crowding out effect of the budget deficit has in reality been prevented (or at least considerably reduced) by the increasing foreign capital inflow. Under Exp.2 where any such effect is ruled out by design, the adjustment occurs in the household savings (note the reduction in consumption). The increase in household savings rate prompted by the necessity to keep investment at the same level as in 1986 (Exp.2) itself shows that the real interest rate must have actually risen between 1982 and 1986. This result is supported by the increase in land rentals by 4.3 % under Exp.2.[10] Without the savings rate adjustment the land rental increases even more: 7.0 % (Exp.1). That is, depending on whether the private

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[10] It is difficult to perceive the entire general equilibrium adjustment that has taken place. However, the difference in the change in land rentals can at least partially be explained by two factors. The higher dollar depreciation under Experiment 1 causes the agricultural exports to increase more than they do under Experiment 2 with a lower depreciation. Also, the increase in household savings and the associated reduction in demand under Experiment 2 results in a lower domestic demand for agricultural commodities. Taken together, the increase in total demand for agricultural products from the base levels is higher under Experiment 1 than under Experiment 2, prompting a bigger increase in output and land use under Experiment 1 (than the increase in output and land use under Experiment 2).

savings adjusted to or simply the investment was crowded out by the budget deficits, the land rentals would have been 4.3 % to 7 % higher in 1986 than they actually were if the foreign savings had not been attracted.

TABLE 1: Changes in Nominal and Real National Income and Components[+]

NIPA Nominal	Value (billions of '86 $)	G N P Share (%)	% Change in Value EXP.1	EXP.2
Consumptn.	2797.414	66.106	- 0.009	- 3.796
Fixed Inv.	652.217	15.412	-19.358	- 0.017
Invntry Inv	6.905	0.163	- 3.055	1.595
Gov't Exp.	872.462	20.617	0.149	0.506
Exports	309.400	7.311	34.668	38.593
Imports	-441.100	-10.424	- 4.218	- 1.460
GDP	4197.298	99.187	0.011	0.573
NFINC	34.400	0.813	9.846	10.255
GNP	4231.698	100.000	0.091	0.652
Real	**(billions of '82 $)**	**(%)**	**EXP.1**	**EXP.2**
Consumptn.	2469.302	66.147	- 0.265	- 4.296
Fixed Inv.	631.992	16.930	-19.650	- 0.017
Invntry Inv	6.543	0.175	- 3.822	0.775
Gov't Exp.	758.476	20.318	0.000	0.000
Exports	318.911	8.543	22.525	26.014
Imports	-482.501	-12.925	-12.338	-10.151
GDP	3702.724	99.187	0.011	0.573
NFINC	30.347	0.813	9.846	10.255
GNP	4231.698	100.000	0.091	0.652

[+] In both experiments, the actual ratio of net foreign capital inflow to GDP in 1982 is maintained in 1986. In Experiment 1 increases in the budget deficit (government savings) is assumed to have crowded out investment. In Experiment 2, investment is fixed and household savings are allowed to adjust.

It is also observed from Table 1 that the percentage decrease in imports in Exp.2 is lower than in Exp.1. Remembering that the dollar depreciation is higher in Exp.2, the result may seem confusing. The reason is the fall in consumption following the increase in saving rate.

TABLE 2: Real Absorption, Foreign Trade and GDP
Agriculture vs. Non-Agriculture (billions of 1982 dollars)[+]

Base Solution

	C	I	G	ABSORB	E	M	(E-M)	GDP
TOTAL	2469.30	631.99	758.48	3859.77	318.91	491.10	-172.19	3702.72
AG	22.91	0.00	10.45	33.36	15.87	6.78	9.09	39.70
NON-AG	2446.39	631.99	748.03	3826.41	303.04	484.32	-181.28	3663.02

Experiment 1

	C	I	G	ABSORB	E	M	(E-M)	GDP
TOTAL	2462.77	507.85	758.48	3729.10	390.72	431.59	-40.87	3703.12
AG	22.61	0.00	10.45	33.07	18.74	6.28	12.46	42.72
NON-AG	2440.16	507.85	748.03	3696.03	371.98	425.31	-53.33	3660.40

Experiment 2

	C	I	G	ABSORB	E	M	(E-M)	GDP
TOTAL	2363.25	627.32	758.48	3749.05	401.84	442.14	-40.30	3723.95
AG	21.75	0.00	10.45	32.21	18.78	6.08	12.70	42.18
NON-AG	2341.50	627.32	748.03	383.06	383.06	436.06	-53.00	3716.84

[+] In both experiments, the actual ratio of net foreign capital inflow to GDP in 1982 is maintained in 1986. In Experiment 1 increases in the budget deficit (government savings) is assumed to have crowded out investment. In Experiment 2, investment is fixed and household savings are allowed to adjust.

Some more detail about these adjustments are given in Table 2. Perhaps the most interesting result in the table is that the real agricultural exports would have been of much greater importance in closing the trade deficit than they were in 1986 or they are today --in the table "X" is real exports and "M" is real imports (inclusive of tariffs) of goods and non-factor services. Notice that the real agricultural trade balance is almost 25 % of the corresponding non-agricultural

balance under both experiments whereas it is only about 5 % in the base year. Another notable result is the change in real agricultural income (see GDP columns in the table).

On the microeconomic side of the results, Tables 3 and 4 show changes in the output, factor use and foreign trade variables by agricultural sectors under each experiment. The numbers in the tables are self-explanatory. The only point that may need drawing attention is the position of dairy and livestock sectors (reminder: DAIRY is a non-tradable sector and the foreign trade in LVSTK sector is very small). These two sectors manage to increase their output under Exp.1 (with resulting factor price ratios) but can not avoid suffering from reductions in output when the consumption falls due to household savings increasing to prevent a crowding-out effect of the budget deficit.

TABLE 3: Percentage Changes from Base Values
Key Agricultural Quantity Variables, Experiment 1
("n.a.": Not Applicable)

	LAND	LABOR	CAPTL	OUTPUT	EXPRT	IMPRT
DAIRY	n.a.	2.03	1.24	1.45	n.a.	n.a.
LVSTK	n.a.	2.83	2.03	2.31	21.89	-14.37
COTTON	0.76	8.70	7.86	6.12	18.28	-29.25
FOODGRN	2.97	11.08	10.23	8.03	17.91	-28.81
FEEDCROP	-2.08	5.64	4.83	2.86	15.80	-26.55
OILCROP	3.41	11.56	10.70	8.64	18.17	-21.41
SUGAR	-4.33	3.21	2.42	1.86	n.a.	- 2.38
OTHCROP	-4.15	3.40	2.61	2.35	21.76	- 3.87

TABLE 4: Percentage Changes from Base Values
Key Agricultural Quantity Variables, Experiment 2
("n.a.": Not Applicable)

	LAND	LABOR	CAPTL	OUTPUT	EXPRT	IMPRT
DAIRY	n.a.	-2.15	-1.78	-1.88	n.a.	n.a.
LVSTK	n.a.	-1.16	-0.79	-0.92	18.95	-17.73
COTTON	2.13	6.74	7.14	5.50	18.96	-31.57
FOODGRN	3.66	8.34	8.75	6.79	18.82	-33.48
FEEDCROP	-2.62	1.77	2.15	0.47	15.96	-30.51
OILCROP	4.04	8.73	9.14	7.27	19.20	-26.28
SUGAR	-5.26	-0.99	-0.61	-1.48	n.a.	- 5.78
OTHCROP	-4.20	0.11	0.49	-0.22	19.47	- 6.52

IV) Summary and Conclusions

The counterfactual experiment results show that, when temporary macroeconomic disequilibria such as unemployment and inflation are ruled out as in the CGE models here, regardless of the proposed adjustment mechanism (i.e., household savings adjustment vs. crowding out of investment) increasing budget deficits would lead to dollar appreciation. Both experiments indicate that the dollar would not have appreciated as much as it did had there been no relationship between the budget deficit and the real interest rate implying the existence rather than an absence of the relationship. This implies that under the same monetary policy and without the budget deficit increase from 1982 to 1986, the U.S. exports would have been higher and imports lower for both the agricultural and non-agricultural sectors. Although the trade deficit would not have been eliminated completely, the agricultural trade surplus would be sizable relative to non-agricultural deficit.

Since the full employment-no inflation assumption is not unrealistic for the period under Reagan administration, the results can be taken to justify the

empirical support for budget deficit-interest rate connection and the TDH found by other researchers, at least for the period under investigation. When foreign capital inflow is restricted, indications arise that the budget deficit tends to increase real interest rates. Had the foreign capital been allowed to increase in response to such real interest rate increases, a different picture would have been observed. Since the experiments are counterfactual, this "different picture" would be the same as the actual picture of the economy observed in 1986.

A sensitivity analysis of results for this study has not been made. However, because of the common data bases the results reported in Adelman and Robinson concerning the sensitivity of the model are applicable here as well: the use of lower trade elasticities do not change the conclusions about the macroeconomic adjustment. Yet no conclusion about the validity of TDH over longer periods can be derived from the analysis here. Instead, it can be argued that the TDH is valid *provided that* the economy is at or sufficiently close to a full employment-no inflation state.

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